

REPORT

OF THE

THIRTY-THIRD MEETING

OF THE



BRITISH ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE;

HELD AT

NEWCASTLE-UPON-TYNE IN AUGUST AND SEPTEMBER 1863.

LONDON:

JOHN MURRAY, ALBEMARLE STREET.

1864.

Report of the Council of the British Association, presented to the General Committee, Wednesday, August 26, 1863.

1. The Report of the Kew Committee has been presented at each of the Meetings of the Council, and the General Report for the year 1862-63 has been received, and is now presented to the General Committee.

2. The Report of the Parliamentary Committee has been received for presentation to the General Committee this day.

3. It will be in the recollection of the General Committee that at the Cambridge Meeting, when Professor Phillips resigned the office of Assistant-General Secretary, which he had held from the beginning of the Association, he was prevailed upon to join Mr. Hopkins as Joint-General Secretary until the present Meeting. The attention of the Council was called to this arrangement on the 5th of June last by Professor Phillips, who, in claiming permission to retire from office, recommended that in filling this office permanently at the Newcastle Meeting, regard should be had to the advantage of having one of the General Secretaries resident in London.

On this a Committee was appointed, consisting of the General Secretaries, and the gentlemen who had formerly filled that office, for the purpose of reporting a recommendation to the Council of a successor to Professor Phillips. The Council have received the following Report:—

“ Professor Phillips, F.R.S., having kindly consented, at the request of the General Committee of the British Association, to hold, in conjunction with Mr. Hopkins, F.R.S., the office of General Secretary, and being now desirous of retiring from the office; We, the undersigned, having been requested by the Council to suggest a suitable successor to Professor Phillips, beg to express our unanimous opinion that Mr. Francis Galton, M.A., F.R.S., of Trinity College, Cambridge, is well qualified to fill the office of Joint-General Secretary of the Association.

“ W. V. HARCOURT.

“ R. I. MURCHISON.

“ E. SABINE.

“ W. HOPKINS.

“ J. PHILLIPS.”

4. The Council have been informed that invitations will be presented to the General Committee, at its Meeting on Monday, August 31st, from Birmingham, Bath, Nottingham, Dundee, Southampton, and the Potteries.

Report of the Kew Committee of the British Association for the Advancement of Science for 1862-1863.

The Committee of the Kew Observatory submit to the Association the following statement of their proceedings during the past year.

It was mentioned in last Report that the Director of the Lisbon Observatory had requested the Committee to superintend the construction of a set of Self-recording Magnetographs. This request has been complied with by the Committee, and a set of Self-recording Magnetographs have been constructed by Adie under their direction. These, along with a tabulating instrument by Gibson, have been verified at Kew, where Señor Capello, of the Lisbon Observatory, resided for some time, in order to become familiar with the working of his instruments.

This verification was completed in December last, and Señor Capello then left England for Lisbon, taking his instruments with him. These arrived safely at their destination; and so rapid was the progress made with the Observatory, that on the 1st of July the building was finished, and the Magnetographs in continuous operation.

Mr. Stewart has lately received from Señor Capello copies of the tracings furnished by these instruments from July 14th to 16th, during which period a magnetic disturbance occurred simultaneously at Lisbon and at Kew. These tracings, along with the corresponding Kew curves, are exhibited to the Association.

When the two sets are viewed side by side, features of resemblance become manifest, which appear to show that very great advantage to magnetical science will ultimately be derived from the intercomparison of such photographic traces taken simultaneously at different localities.

Mr. Stewart has likewise heard from Señor De Souza, of the University of Coimbra, who writes that, after many preliminary difficulties, his Observatory is now making rapid progress towards completion.

Before his departure from this country, Señor Capello addressed the following letter to the Chairman of the Kew Committee:—

“Kew Observatory, November 28, 1862.

“MY DEAR SIR,—I should much desire to obtain for the Lisbon Observatory some memorial of my visit to Kew, where I have received much valuable instruction in Magnetism, as well as great kindness from yourself, from General Sabine, and from other Members of the Kew Committee.

“Might I request of you, dear Sir, to endeavour to obtain for me a set of the ‘Transactions of the British Association,’ wherewith to enrich our Library at Lisbon?

“Will you also at the same time kindly permit us to continue sending to your Library, as a slight token of our goodwill, the monthly records of our Observatory?

“I remain,

“Dear Sir,

“Yours sincerely,

(Signed) “J. C. BRITO CAPELLO.”

“J. P. Gassiot, Esq., F.R.S.,
Chairman of the Kew Committee of the
British Association.”

The request of this letter has been complied with by the Council of the Association, and a complete set of the ‘Transactions’ have been despatched to Lisbon.

The Committee have likewise been requested to superintend the construction of a set of Self-recording Magnetographs for Prof. Kupffer, of the St. Petersburg Central Observatory. These were constructed as before, the Magnetographs by Adie, and the tabulating instrument by Gibson; and, after having been verified at Kew, they were despatched to St. Petersburg.

Prof. Kupffer desired also a Differential Vertical-force Magnetometer for Pekin, which has likewise been constructed by Adie, and verified at Kew; it remains in readiness to be forwarded by the first suitable opportunity to its destination.

In addition to these instruments, Prof. Kupffer is obtaining from Adie a Barograph and a Self-registering Anemometer, both of the Kew pattern.

Prof. Kupffer proposes visiting Kew in October, for the purpose of acquainting himself with the mode of working the instruments adopted there.

It was mentioned in last Report that Lieut. Rokeby, of the Royal Marines, was desirous of making magnetical and meteorological observations in the Island of Ascension during his term of service at that station, and that the Board of Trade had sanctioned the expenditure of £60 to provide a suitable Observatory.

Lieut. Rokeby has since been zealously engaged with his observations, and has already transmitted the records to General Sabine.

In order to complete his meteorological equipment, a Self-recording Anemometer was necessary, and one of these on the Kew pattern has been constructed by Adie, and forwarded to Ascension, for the cost of which application has been made to the Government Grant Committee of the Royal Society.

It may be allowed to use this opportunity of stating, that already no fewer than nine Self-recording Anemometers on Beckley's or the Kew pattern have been made for different Observatories.

The Observatory of the McGill College at Montreal has been completed, and Dr. Smallwood writes that the absolute determination of the three magnetic elements and hourly observations of the Declinometer were to have been commenced there in July last.

The usual monthly absolute determinations of the magnetic elements continue to be made at Kew, and the Self-recording Magnetographs are in constant operation as heretofore, under the zealous superintendence of Mr. Chambers, the Magnetical Assistant.

Advantage has been taken of these automatic records of the earth's magnetism by the Committee engaged in the preparation of electrical standards, who have found it desirable for some of their experiments to ascertain the contemporaneous readings of the Declination Magnetograph.

The extensive use of iron in the construction of modern ships has rendered a careful determination of its effect upon ships' compasses essentially requisite to safe navigation. A demand has consequently arisen for the aid of persons who have made the subject one of special study, in order to make the observations that are most desirable, and to supply the required information, the process generally adopted being to swing the vessel round with her head towards the different points of the compass in succession. The needs of the Royal Navy in this respect are amply provided for; but hitherto Government has taken no steps towards extending the system adopted in that department to ships of the Mercantile Marine. On this account the Committee have much pleasure in reporting that Mr. Chambers has practically taken up the subject, and has obtained from the Director of the Observatory occasional leave of absence, when this shall be necessary, to enable him to attend at the swinging of ships. In this work his long experience of accurate and varied magnetic observations at Kew, and his familiar acquaintance with the "theory of deviations of the compass," must prove to be of great value; and the Committee desire to record their opinion that in thus affording to the observers at Kew an excellent training, which is capable of most useful application in the public service, the maintenance of the Observatory is shown to be attended with indirect advantages scarcely less important than the valuable results of observations which it is the more immediate province of the Observatory to secure.

Major-General Sabine, President of the Royal Society, has communicated to that body a paper on the "Results of the Magnetic Observations at the Kew 1863.

Observatory, from 1857 to 1862 inclusive." In this communication the following subjects are discussed:—

1. The disturbance-diurnal variation of the declination.
2. The solar-diurnal variation of the declination.
3. The semiannual inequality of the solar-diurnal variation of the declination.
4. The lunar-diurnal variation of the declination.
5. The secular change, and the annual variation of the declination, dip, and total force.

The values of these changes at Kew are compared with those at the different Colonial Magnetic Observatories, and results of much interest and importance are obtained.

A copy of this paper will be sent to each Member of the Committee of Recommendations of the Association as soon as it is out of the printer's hands.

At the request of the Astronomer Royal, the Kew curves of declination and horizontal force for 14th December last (a time of disturbance) were forwarded to Greenwich, in order that Mr. Airy might compare them with the records of earth-currents obtained there at the same date.

In return Mr. Airy kindly sent copies of these latter records to Kew, and a comparison of these with the indications afforded by the Kew Magnetographs forms the subject of a short communication by Mr. Stewart, which is published in the Proceedings of the Royal Society.

Mr. Stewart has likewise communicated to the Royal Society of Edinburgh a paper on "Earth Currents during Magnetic Calms, and their Connexion with Magnetic Changes," which is about to be published in the Transactions of that body. He has likewise communicated to the Royal Society of London an account of some experiments made at Kew, in order to determine the increase between 32° Fahr. and 212° Fahr. of the elasticity of dry atmospheric air, the volume of which remains constant, and also to determine the freezing-point of mercury.

This communication will be published in the Transactions of the Royal Society. The experiments were made by means of an air-thermometer, in the construction of which great assistance was derived from Mr. Beckley, Mechanical Assistant, while Mr. George Whipple, Meteorological Assistant, was of much use in observing.

Mr. Chambers has communicated to the Royal Society a paper "On the Nature of the Sun's Magnetic Action upon the Earth," in which it is argued that, in causing the daily variation, the sun does not act as a magnet.

The Meteorological work of the Observatory continues to be performed satisfactorily by Mr. George Whipple, and all the Staff interest themselves much in the business of the Observatory.

During the past year

130 Barometers,
296 Thermometers, and
22 Hydrometers

have been verified; and Mr. Kemp, philosophical instrument maker, Edinburgh, has been furnished with a standard Thermometer.

The self-recording Barograph has been in constant operation since 8th November last. A suggestion by Mr. Beckley to put two papers at the same time upon the cylinder, the one under the other, has proved successful; and two traces have thus been secured, one of which has been regularly forwarded

to Admiral FitzRoy, at his request, while the other has been retained at the Observatory.

On 30th December, the Superintendent received the following letter from Admiral FitzRoy:—

“Meteorological Department, 2 Parliament Street, London,
30th December, 1862.

“SIR,—I have the honour of addressing the Kew Committee of the British Association, through yourself, as Superintendent at their Magnetic and Meteorologic Observatory, to request, on behalf of the Board of Trade, that daily meteorologic communications may be again made to this Office, as formerly.

“Having extended our operations, and therefore incurred greater responsibility, it is considered advisable to acquire, if possible, the best strengthening support available.

“On account of economical reasons solely, as you are aware, the Board of Trade asked for discontinuance of those Kew telegrams (which were then received as regularly as satisfactorily); but now, being able to add their expense (comparatively small) to the current charges of this Office, it is my pleasing duty to make this application.

“The Kew Observatory *is so well situated* for Meteorologic purposes, because separated from all *local* causes of error—neither on a hill nor in a valley, surrounded by grass land, on a level only about 35 feet above the sea, and to *windward* of our extensive Metropolis during the greater part of the year—that a better locality for reference and intercomparison need not be desired.

“It is sufficiently far from London to be uninfluenced by its *heated air*, smoke, or other *peculiarities* of atmosphere (inseparable from such an area of fires, population, and *altered radiation*), while it is within an easy railway trip.

“But while such are the well-known exterior recommendations of the Kew Observatory for its *specialities* of Magnetism and Meteorology, there are sterling advantages obtainable within its walls not to be found elsewhere. Scrupulously careful, exact, and truly-principled observations (inseparably connected with the names of Ronalds and Welsh) gave character and initiated proceedings of which results are now patent—not only in improvements of many kinds, affecting instruments and methods, but in *general* instruction.

“Nowhere else is there a *Cathetometer* by which barometric instruments can be perfectly *verified*. Other methods used elsewhere are inferior as to range, principle, and practice. To that instrument much more is due than may be yet generally recognized.

“Persons aware of these facts are naturally desirous that Kew should have a place in the reports now published daily in most of the newspapers, and as the Board of Trade will defray such small contingent expenses as may be requisite, I am led to believe that the Kew Committee will consent to the necessary steps, through your obliging attention.

“With this letter is a copy of the arrangements existing now, which are somewhat altered from those already known to yourself.

“It may be convenient to permit morning observations to be made, soon after eight, by a resident at the Observatory, and to employ a special messenger to carry them to the Telegraph Office, in order that we may receive them here early. The contingent charge would be borne by this Office.

“Lists of the places with which we now communicate, and forms for our daily Weather Reports, are enclosed—all which may help to show what im-

portance should be attached to the cooperation and prestige of the Kew Observatory.

“ I have the honour to be,

“ Sir,

“ Your obedient Servant,

(Signed) “ ROBT. FITZROY.”

“ *Balfour Stewart, Esq., F.R.S.,*
“ *Superintending Kew Observatory.*”

In compliance with the request of this letter, telegrams were regularly furnished up to the end of May; but at that date the Superintendent received another letter from the Admiral, thanking the Observatory for the regularity and accuracy of its telegrams, but mentioning that, in consequence of two additional Foreign Stations being added to his list, there would not be space available for Kew, which really gave nearly the same indications as London. In consequence of this, telegrams were discontinued after the end of May.

The self-recording Electrometer of Prof. W. Thomson continues in constant operation.

The arrangements at the Observatory for testing Sextants remain as before without alteration, but it has been thought advisable to reduce the verification-fee from 5*s.* to 2*s.* 6*d.* for ordinary instruments, leaving that for an extremely accurate verification of a superior instrument the same as before.

Eleven sextants and one altitude and azimuth instrument have been verified at Kew since the last Meeting of the British Association.

The Chairman has procured a Spectroscope affording very great angular separation, which remains at Kew, and he has also ordered a Heliostat from Paris; by those means it is hoped that the minutiae of the solar spectrum may soon be capable of being examined with great facility.

The solar spots are now regularly observed at Kew, after the method of Dr. Schwabe, of Dessau, who has been communicated with, and will be written to from time to time, in order to ensure that both observers pursue exactly the same method of observation.

It will be remembered that in the Report of the Committee at the Cambridge Meeting, it was stated that Mr. De la Rue had taken 177 photographs of the sun, and that the number of available days from February 7 to September 12, 1862, was 124. The Kew Heliograph was worked at Cranford up to February 7, 1863, and photographs were procured on 42 other days between Sept. 12, 1862, and February 7, 1863, making 166 working days in the whole year. The series of negatives are now in course of measurement and reduction by Dr. Von Bose; the micrometer employed is the same as that constructed for and used in the measurements of the eclipse-pictures obtained in Spain in 1860, a detailed description of which instrument is given in Mr. De la Rue's paper in the *Phil. Trans.* vol. clii. pp. 373 to 380.

Of the 1862-1863 series, the measurements are finished up to the end of June, and the reductions to the end of April 1862; both will be completed at the end of this year.

In February of the present year the Heliograph was removed from Cranford to the Kew Observatory, and erected again in the dome. A new and commodious photographic-room has been built on the roof of the Observatory, close to the dome, and has been fitted up with the requirements necessary for the successful prosecution of astronomical photography. The expense of this room has been defrayed out of the sum of £100 granted for that object at the

Accounts of the Kew Committee of the British Association from October 1, 1862 to August 26, 1863.

RECEIPTS.

	£	s.	d.
Received from the General Treasurer	600	0	0
" for the verification of Instruments— £ s. d.			
from the Board of Trade	5	15	0
from the Admiralty	15	5	0
from Opticians	28	17	6
" for Barograph curves sent to the Meteorologic Office, London 16 14 3			
from the Portuguese Govern- ment for the verification of Magnetographs sent to the Lisbon Observatory.....	30	0	0
" for the construction of standard Thermometers.....	1	15	0
Balance.....	98	6	9
	189	11	0
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	£887	17	9
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PAYMENTS.

	£	s.	d.
Balance from last account	182	2	6
Salaries, &c. :—			
To B. Stewart, four quarters, ending 1st October, 1863	200	0	0
Ditto, allowed for petty travelling ex- penses.....	10	0	0
C. Chambers, four quarters, ending 6th October, 1863	100	0	0
Ditto, honorarium.....	10	0	0
G. Whipple, four quarters, ending 18th September, 1863	60	0	0
T. Baker, four quarters, ending 29th September, 1863.....	40	0	0
R. Beckley, 47 weeks, ending 24th August, 1863, at 40s.....	94	0	0
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	514	0	0
Apparatus, Materials, Tools, &c.	60	10	0
Ironmonger, Carpenter, and Mason.....	7	5	5
Printing, Stationery, Books, and Postage...	31	16	9
Coals and Gas	49	9	5
House Expenses, Chandlery, &c.	15	3	0
Porterage and petty expenses	16	10	8
Rent of Land to 10th October, 1863	11	0	0
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	£887	17	9
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I have examined the above account and compared it with the vouchers presented to me. I find that the amounts expended exceed those received by the sum of

To which must be added the excess of expenditure over income for the preceding years, as stated in the account of 17th September, 1862.....

Making the present balance of expenditure beyond receipts

12th August, 1863.

R. HUTTON.

Cambridge Meeting. The actual sum expended up to the present time amounts to £89, leaving a balance of £11, which will cover the outlay for a few pieces of apparatus which are still required.

Between February 7 and May of the present year pictures of the sun were occasionally procured at Kew; but the Heliograph could not be fairly got to work until the completion of the photographic-room and the final adjustment of the instrument itself. From the 1st of May to the present time the Heliograph has been continuously worked by a qualified Assistant, under the immediate supervision of Mr. Beckley. Two photographs are taken on every working day, one to the east, and the other to the west of the meridian, when atmospheric conditions permit of this being done. From May 1st to August 14th inclusive, there have been fifty-four working days. Four positive copies are made regularly from each negative, one of which it is proposed to retain at Kew, and it is in contemplation to distribute the others.

Mr. Stewart, after an inspection of all the sun-pictures obtained by the Kew Heliograph, is inclined to think that the behaviour of solar spots with respect to increase and diminution has reference to ecliptical longitudes, and is possibly connected with the position of the nearer planets; but it will require a longer series of pictures to determine this, than that which has yet been obtained.

The Heliograph constructed by Mr. Dallmeyer for Wilna, under Mr. De la Rue's superintendence, has been completed, and will be shortly sent to Russia, together with a micrometer and protractor constructed by Messrs. Troughton and Simms, which will be employed in the measurement and reduction of the sun-pictures.

Of the £150 granted by the Association in 1861 for the purpose of obtaining a series of photographic pictures of the solar surface, a sum of £137 3s. has been expended from February 1862 to February 1863, and the balance, £12 17s., has been returned to the Association.

In 1860 a sum of £90 was voted for an additional Photographic Assistant, of which £50 was received and expended in that year. The balance, £40, was again granted in 1861, out of which £20 2s. 10d. have been expended.

The working of the Kew Photoheliograph during the year, commencing in February 1863, will be defrayed out of a grant placed in the hands of Mr. De la Rue by the Royal Society for that purpose.

It will be seen from the Statement appended to this Report, that the expenditure of the Observatory has exceeded its income by £7 8s. 6d.; but there is £30 to be received from the Russian Government for the verification of instruments. The Committee recommend that a sum of £600 should be granted for the expenditure of the current year.

Kew Observatory,
14 August, 1863.

JOHN P. GASSIOT,
Chairman.

Report of the Parliamentary Committee, to the Meeting of the British Association, at Newcastle-on-Tyne, in August, 1863.

The Parliamentary Committee have the honour to report as follows:—

“The Earls of Rosse and De Grey, Lord Stanley, and Sir Joseph Paxton have vacated their seats; but your Committee recommend that Lords Rosse and Stanley be re-elected.

“Your Committee also recommend that two of the vacancies be supplied by the election of Lord Houghton and Mr. N. Kendall.